Society of Petroleum Engineers
Dallas Houston Kuala Lumpur London

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Director of Operations, Asia Pacific

17 September 1998

To: 1998 SPE Applied Technology Workshop
"Cost Effective/Practical Reservoir Management" Steering Committee
23-26 August 1998 • Bandar Seri Begawan, Brunei Darussalam

Re: Attendee List, Participant Evaluation and Workshop Summaries

Enclosed are participant evaluation and workshop summaries along with final delegate listing by last names, with company address/telephone/facsimile information for the forty-three (43) participants who attended the 1998 SPE Applied Technology Workshop on "Cost Effective/ Practical Reservoir Management" held 23-26 August 1998 in Bandar Seri Begawan, Brunei Darussalam.

The overall comments from the delegates were positive and we thank you for your contributions to a successful workshop. The success of any workshop always depends on the effort of the Steering Committee, and we were fortunate to have the opportunity to work with a very dedicated group of people.

Our thanks again to the Steering Committee for an outstanding job and we look forward to having the opportunity of working with you on a variety of projects in the future.

Sincerely ,

Cordella W. Gillett

Cordella Wong Gillett
Director of Operations, Asia Pacific

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c.c. Mr. Peter Behrenbruch, SPE Director - Asia Pacific Region

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WORKSHOP SUMMARY

BRUNEI APPLIED TECHNOLOGY WORKSHOP
COST-EFFECTIVE/PRACTICAL RESERVOIR MANAGEMENT
23-26 AUGUST 1998 BANDAR SERI BEGAWAN, BRUNEI DARUSSALAM

Dinner Address

"Total Asset Management Strategy for McKee Field" Paul Moore, Fletcher Challenge

Redevelopment with efforts focused on cost reduction resulted in substantial reserve additions. 3D seismic and challenges/review of previous practices thru integrated asset teams were instrumental in this effort. Highlighted new technologies and concerted, focused efforts to create added value.

Keynote Address

"Life Cycle Planning and Uncertainty" Dr. Emmanuel Egbogah, Vision Reservoir Management Technologies

Reservoir management should employ latest technology and take whatever steps are necessary to improve staff productivity to maximize value creation. Uncertainty sources and mitigation must be assessed and addressed.

Session #1 - Exploration and Appraisal

"Unocal's Saturation Exploration (SX) Philosophy" Ingiye Tsai, Unocal

Exploration wells are to find oil/gas, not for production. Therefore, drilling lower-cost wells should allow more prospects to be tested given the same budget compared to conventional exploration programs. Unocal has made extensive use of slim-hole wells combined with a wireline formation tester (pressure/sample collection) to minimize drilling costs. Also used pre-laid mooring system to minimize the amount of rig move time.

"Stratigraphic Control on the Reservoir Quality of Shallow Marine Sandstones" Mohammad Sarif, University of Darussalam

Used sequence stratigraphic and petrographic analysis of three shoreface sandstone deposit outcrops to identify reservoir quality variations as a function of relative stratigraphic positions (highstand, lowstand, or transgressive).

" Integration of Seismic, Geological and Petrophysical Data to Improve Reservoir Characterisation - Kutai Basin East Kalimantan, Indonesia" Peter Lloyd, Schlumberger

Matched seismic attributes to well data, thus calibrating the seismic, incorporated sequence stratigraphy, and then generated maps from the seismic data to guide infill drilling. In one East Kalimantan field, drilling success went from 1 success/7 total wells to a success ratio of 4 successes/4 total wells. The technique can be very successful, but it does not work in all areas - shallow gas and overpressures can cause problems.

"Reservoir Characterisation Using Seismic Inversion Modelling and Attribute Analysis" Sagar Ronghe, University of Darussalam

Inverse modeling techniques provides much better clarity of formation features (lithologic variations and fluid content) compared to conventional seismic modeling. In addition, this technique can be used to estimate reservoir porosity which compares favorably with wireline log porosity.

Session #2 - Appraisal and Development

"Reservoir Management of Thin Oil Columns" D. T. Vo, Unocal

For thin oil column reservoirs (30-50 ft thick) with small gas cap (< 1 BCF/MMSTB OOIP) complete higher in column, leaving a minimum or no standoff. For larger gas caps, leave a minimum standoff of 5 ft between the top perforation and the gas cap. Attempt to produce well at low GOR (< 3 x Rsi) for better ultimate reovery. Drill horizontal (or high angle) wells and keep the well course simple.

"Reservoir Risk Management - Multidisciplinary Team Approach" Daniel Prevot, D. F. Doucy, Elf

Discussed a fast track (2 year) development of deep, geologically-complex gas field offshore Brunei. Monobore wellbores with straddle packer/sliding sleeves will be used to control production from the multiple, stacked sands. Wells designed to allow zone shut-in without need for a rig. Significant safety factor in deliverability was decided upon - six wells, with each well capable of producing the total field contract quantity, and each well had the ability to shut-off sand packages which might water out.

"Drilling Hazard Prediction Using Drill Bit Seismic" William Borland, Schlumberger

Seismic sensors on the surface can be used to provide seismic data which are generated by tri-cone drill bits while drilling. Most frequent uses are casing point and drilling hazard prediction in real time.

'The Geoscientist as Well Planner - A New Approach to Fast Track Developments" Ivan Kok, Landmark Graphics

A software package was presented which combined the geologic work station with the drilling engineering well planning package. The advantage is the immediate feedback to geoscientists of well feasibility and practicality.

Session #3 - Production/IOR/Depletion

"Field Depletion Studies - Seligi and Guntong Fields" Samsuddin Selamat, EPMI

After recovery of about 60% of EUR, performance of Seligi and Guntong fields began to deviate from predictions. The reservoir management teams initiated depletion studies to identify causes for the deviations and suggest ways to improve reservoir performance and predictions. One of the major techniques used was intergration of sequence stratigraphy studies, bubble maps, and net pay maps to identify infill opportunities. Simulation models were calibrated to production data (Guntong) or re-built (Seligi) based on new the sequence stratigraphy/production data.

"In-situ Redistribution of Dormant Gas Reservoir Energy to Maximize Oil Production" Diederik Boersma, BSP

Proposed direct gas injection into secondary gas cap of oil reservoir from a structurally lower, higher-pressured gas zone. Technique involves producing lower gas zone into tubing, and flowing that gas out through a sliding sleeve into the secondary gas cap in the same wellbore - the gas will not be produced to surface. This gas flood scheme should improve oil recovery from the flooded zone with no loss in eventual gas recovery.

"Champion Block 14 - Integrating New Technology to Achieve a 60% Unit Cost Reduction" Onno Van Kessel, BSP

New technologies (splitter wellheads, ERD, remote-controlled SSDs, computing) and further work (3D seismic, sequence stratigraphy, simulation, platform structural analysis) resulted in re-development program for Champion Block 14 at a cost of US$ 2/incremental barrel, compared to an initial re-development plan cost of US$ 4.7/incremental barrel.

"Impact of Seabed Multicomponent Sensors on Reservoir Management" Alastair Fenwick, Geco-Prakla Marine

Presented an overview of seismic techniques which aid reservoir management optimization:

4D (time lapse monitoring) - 4th component being time, also called repeat seismic
4C (3 component geophone and hydrophone) - records pressure and shear wave data

Application of 4C seismic
- imaging within/beneath gas invaded zones
- imaging base of/beneath salt
- deepwater multiple removal
- lithology identification

Changes in seismic character as reservoirs are produced are indicative of saturation changes. 4D seismic has been successfully used in the North Sea for reservoir management (for example, in identifying undrained reserves).

Panel Discussion

All panelists (Elf, Shell, Brunei Petroleum Unit, Unocal, Esso) advocated use of multidisciplinary teams in their reservoir management activities.

Some variations.

Shell: flexibility in their developments to react to performance or future contractual changes

Elf: continuity of the team members

Esso: mix of analytical and numerical techniques

Unocal: aggressive cost-cutting, rethinking of assumptions

BPU: conservative but flexible production management policy.

Concluding Keynote

"Enhancing Process Performance in Reservoir Management" Ken Muir, Smedvig

Suggested that companies are good at planning and executing projects, but need improvement in reviewing and improving their processes. Suggested that process mapping is a way to improve the efficiency of reservoir management activities.

ATTACHMENT A

SOCIETY OF PETROLEUM ENGINEERS
APPLIED TECHNOLOGY WORKSHOP
"COST EFFECTIVE/PRACTICAL RESERVOIR MANAGEMENT"
23-26 August 1998 • Brunei

Comments:

1) Attendees should never judge the opinions given. Constructive feed back should be given instead. The mediators should take on the job to avoid these incidents.

2) More time for syndicate exercise. Smaller group for syndicate exercise. Avoid papers which do not fit in this workshop.

3) The presentation equipment was insufficient in that modern projection system via the PC was not available. The sitting arrangement was not satisfactory; round table arrangement is preferred.

4) Reduce workshop costs. Rework breakout problems to simplify/clarify them, and add more problems while allowing some amount of time.

The papers/presentations in my view were not always focussed enough on the title of the workshop. Overall, I believe the programme was good. I think SPE has played a significant role by providing a professional forum in which technical professional from Brunei's traditional National Oil Company can mix with those of the new entrants in a new political environment.

Vincent did an excellent job and should be especially commended.

5) Good exercise and well plan, this make each team works hard and try to give the best they have.

6) For the next, I recommend to present more applicable new technology, it can be applied in many area.

7) A well mixed of audience and vast experience and representations of companies, especially in the region, make the workshop a success. Certainly, the excellent organization of the workshop by the committee is a big part of it. I truly enjoy the presentations, discussion and friendship exchanged during the workshop.

8) The workshop is useful to share experience. Application of other's experience to my company is a potential.

9) Very informative and beneficial. Technical content appropriate for both geoscience and engineering professionals.

17) Fine job by organising committee in making this first SPE workshop in Brunei happens. Some "filler talks" of topics of dubious relevance to workshop. (e.g. talk on stratigraphy of Labuan Island sandstones). Great location. Breakout task was highlight of workshop, intense exchange of ideas.

18) This was more a development-planning workshop, not reservoir management. Nothing or next to nothing on data acquisition, key performance indicator reservoir management, not enough on gas reservoirs, not enough on reservoirs under production. Disappointing.

19) More time spend on Life Cycle Planning and Uncertainty will be beneficial. Meeting room - for the setting arrangement, it will be better if they arrange in semi-circle patterns for easy interaction between the participants.

20) Additional distinguished keynote speakers should have been invited. Some talks (mine included) were only indirectly relevant to the workshop objectives. Their acceptance should have been given a second thought.